IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

ALIGN TECHNOLOGY, INC., Plaintiff and Counterclaim Defendant, v. 3SHAPE TRIOS A/S and 3SHAPE A/S, Defendants and Counterclaimants.	Civil Action No. 6:20-cv-00979-ADA

3SHAPE'S OPENING BRIEF ON CLAIM CONSTRUCTION

Kimberly Coghill *(pro hac vice)*
Bryan J. Cannon *(pro hac vice)*
TROUTMAN PEPPER HAMILTON SANDERS LLP
401 9th Street, N.W.
Suite 1000
Washington, D.C. 20004
Tel: 202.274.2950
Fax: 202.274.2994

William D. Belanger *(pro hac vice)*
Gregory Len *(pro hac vice)*
Frank D. Liu *(pro hac vice)*
Brittanee Petrik *(pro hac vice)*
Ana Spone *(pro hac vice)*
Gwendolyn Tawresey *(pro hac vice)*
TROUTMAN PEPPER HAMILTON SANDERS LLP
125 High Street
19th Floor, High Street Tower
Boston, MA 02110
Tel: 617.204.5100
Fax: 617.204.5150
Email: 3Shape979Troutman@Troutman.com

Bruce S. Sostek (No. 1885570)
Bruce.Sostek@tklaw.com
Max Ciccarelli (No. 00787242)
Max.Ciccarelli@tklaw.com
Thompson & Knight LLP
One Arts Plaza
1722 Routh Street
Suite 1500
Dallas, TX 75201-2533
Tel: 214.969.1237
Fax: 214.880.3252

Counsel for 3Shape Trios A/S and 3Shape A/S

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2	Defendants and Counterclaim Plaintiffs 3Shape A/S and 3Shape TRIOS A/S's Updated Proposed Claim Constructions dated June 11, 2021
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4	U.S. Patent No. 9,101,433 (Align-TX_0010063)
5	U.S. Patent No. 10,728,519 (Align-TX_0010123)
6	U.S. Patent No. 10,750,151 (Align-TX_0010161)
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18	File History for U.S. Patent No. 10,750,151 (Excerpt) – Notice of Allowance dated July 6, 2020
19	File History for U.S. Patent No. 10,750,152 (Excerpt) – Notice of Allowance dated June 23, 2020
20	*3Shape A/S and 3Shape Inc. v. Align Technology, Inc.*, No. IPR2019-00163, Paper No. 14 (P.T.A.B. Sept. 26, 2019)
21	Donald Hearn, *Computer Graphics, C Version*
22	Handbook of Computer Vision and Applications (Vol. 1)
23	Declaration of David Schaafsma, Ph.D. in Support of 3Shape's Opening Brief on Claim Construction dated June 16, 2021
24	U.S. Patent No. 9,675,430
25	Inv. No. 337-TA-1091, Complainant Align Technology, Inc.'s Initial Post Hearing Brief, Oct. 5, 2018 (Public Version)
26	Inv. No. 337-TA-1091, Hearing Transcript, Sep. 18, 2018
27	*3Shape A/S and 3Shape Inc. v. Align Technology, Inc.*, No. IPR2019-00163, Paper No. 37 (P.T.A.B. June, 9, 2020)
28	*3Shape A/S and 3Shape Inc. v. Align Technology, Inc.*, No. IPR2019-00163, Ex. 2041 (P.T.A.B. Sept. 26, 2019)
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33	File History for U.S. Patent No. 10,945,609 (Align-TX_0010471) (Excerpt) – Notice of Allowability dated Nov. 18, 2020
34	Notice of Allowance for 16/176474 dated Nov. 27, 2019
35	Intl. Pub. No. WO 00/08415 (Align-TX_0022830)

36	Declaration of J.P. Mellor, Ph.D. Regarding U.S. Patent Nos. 10,791,936; 10,945,609; and 10,709,527 dated June 16, 2021
37	Inv. No. 337-TA-1090, Initial Determination on Violation of Section 337; Recommended Determination on Remedy and Bonding, Apr. 26, 2019 (Public Version)

TABLE OF ABBREVIATIONS

Abbreviation	Description
’538 patent	U.S. Patent No. 8,102,538, part of the “Color Scanning Patent Family”
’228 patent	U.S. Patent No. 8,363,228, part of the “Color Scanning Patent Family”
’456 patent	U.S. Patent No. 8,451,456, part of the “Color Scanning Patent Family”
’207 patent	U.S. Patent No. 8,675,207, part of the “Color Scanning Patent Family”
’433 patent	U.S. Patent No. 9,101,433, part of the “Color Scanning Patent Family”
’519 patent	U.S. Patent No. 10,728,519, part of the “Color Scanning Patent Family”
’151 patent	U.S. Patent No. 10,750,151, part of the “Color Scanning Patent Family”
’152 patent	U.S. Patent No. 10,750,152, part of the “Color Scanning Patent Family”
’829 patent	U.S. Patent No. 7,511,829, part of the “Color Scanning Patent Family”
’936 patent	U.S. Patent No. 10,791,936, part of the “Selective Rescanning Patent Family”
’609 patent	U.S. Patent No. 10,945,609, part of the “Selective Rescanning Patent Family”
1091 ITC Investigation	*Certain Color Intraoral Scanners and Hardware*, Inv. No. 337-TA-1091 (U.S.I.T.C.)
3Shape or Defendants	3Shape A/S and 3Shape Trios A/S, collectively
3D	Three-dimensional
2D	Two-dimensional
ALJ	Administrative Law Judge
Align or Plaintiff	Align Technology, Inc.
Asserted Patents	U.S. Patent Nos. 9,101,433; 10,728,519; 10,750,151; 10,750,152; 10,791,936; 10,945,609; and 10,709,527, collectively
Babayoff ’415	WO 00/08415 reference
Color Scanning Patents	U.S. Patent Nos. 9,101,433; 10,728,519; 10,750,151; and 10,750,152, collectively
Hole Closing Patent or ’527 patent	U.S. Patent No. 10,709,527
IPR	*Inter partes* review
ITC	International Trade Commission
POSITA	Person of ordinary skill in the art
Selective Rescanning Patents	U.S. Patent Nos. 10,791,936 and 10,945,609, collectively

*emphasis added unless otherwise indicated

Pursuant to the Scheduling Order (Dkt. 82) and by agreement of the parties, 3Shape hereby submits its opening claim construction brief addressing Align's Asserted Patents.

I. COLOR SCANNING PATENTS

Background. The Color Scanning Patents are generally directed to a system and method for determining the 3D surface topology and associated color of 3D structures, including intraoral structures such as teeth. Techniques for determining the 3D surface topology and associated color of such 3D structures were already well known in the art. (*See, e.g.*, '433 patent, 2:8–52; *see also* Ex. 11.) The Color Scanning Patents address the particular issue of mismatched 2D color information and 3D surface models, where the 3D surface model is acquired using a 3D scanning method and the 2D color information is acquired using a 2D imaging method. (*See* '433 patent, 1:59–2:7.) In particular, the Color Scanning Patents address this issue by obtaining "a two dimensional (2D) color image of the 3D structure that is being scanned… typically within a short time interval with respect to the 3D scan" to allow "each X-Y point on the 2D [color] image [to] substantially correspond[] to a similar point on the 3D scan having the same relative X-Y values." ('433 patent, 4:3–17.) This allows for "a relatively simple and effective way for mapping 2D color information onto a 3D surface model." ('433 patent, 4:41–43.)

Key Differentiator Over the Prior Art. The Color Scanning Patents are part of a larger patent family[1] and claim priority to a provisional application filed in June 2004. The asserted Color Scanning Patents, however, were filed between 10–15 years after the provisional.[2] During

[1] A family tree of the Color Scanning Patent family is attached hereto as Exhibit 11.

[2] The '433 patent was filed in October 2014, the '519 patent in April 2019, the '151 patent in February 2020, and the '152 patent in April 2020.

prosecution, the patentee distinguished the invention from the prior art on the basis that the prior art did not disclose "depth data [that] is obtained independently of the colour data." (Ex. 12 at 14.) The examiner recognized and relied on this distinction to allow patents in the Color Scanning Patent family. (Ex. 13 at 3.) This distinction is also consistent with the specification of the Color Scanning Patents, which describes that color data captured as part of the 2D image independently obtains depth data needed to acquire 3D information. (*See, e.g.*, '433 patent, FIG. 1, 4:3–42.)

Prior Litigation History. Align and 3Shape have previously litigated patents in the Color Scanning Patent family, including the '433 patent. In each case, the asserted claims were found invalid (*e.g.*, the '228, '456,'207 and '538 patents) and/or the 3Shape products accused of infringement – including the Trios scanners accused here – were found not to infringe (*e.g.*, the '538 and '433 patents). (*See* Ex. 11.) 3Shape also filed IPRs against patents in the Color Scanning Patent family (including the '433 patent) in which Align narrowly read the claims to distinguish the asserted prior art. (*Id.*) Both the prosecution and litigation history inform the proper construction for the Color Scanning Patents.

3Shape's constructions reflect the proper scope and meaning of the claims in light of the specification and the prosecution history. Accordingly, for the reasons set forth below, the Court should adopt 3Shape's constructions.

A. [Issue A] Terms Relating to Whether Depth Data is Obtained Independently of Color Data[3]

The ITC previously decided the parties' primary dispute, whether the patentee disclaimed depth data that is not obtained independently of the color data, in 3Shape's favor, over Align's objections. This Court should do the same.

1. [A.1] "depth data" ('433 Patent 1, 2, 12, 13, 16; '519 Patent 1, 6, 13, 21, 24; '151 Patent 1, 10, 18, 25; '152 Patent 1, 9, 16, 23)

Align attempts to recapture claim scope it explicitly disclaimed during prosecution through its proposal for plain and ordinary meaning and its alternative construction. Specifically, Align attempts to recapture two aspects: (1) that depth data refers to 3D points generally rather than 3D "surface points," and (2) that color data does not need to be obtained independently of the 3D surface points. Such recapture is impermissible. 3Shape's construction, on the other hand, reflects both the specification and Align's claim scope disclaimer.

a. Depth Data Refers to 3D Surface Points

The specification confirms that depth data refers to 3D surface points. The stated purpose of the alleged invention is to determine the 3D surface topology, made up of a collection of 3D surface points, of a 3D structure. ('433 patent, 1:38–40 (invention directed to "obtaining the three dimensional location of surface points of an object…"), 2:56–58 ("In accordance with the present invention, a device and method for determining surface topology and color...").) The preamble of the asserted claims also reflects this purpose. (*See, e.g.*, '433 patent, cl. 1 ("A system for determining surface topology and associated color…"); '519 patent, cl. 1 (same); '151 patent, cl. 1 ("A method for determining surface topology and associated color…").)

[3] A table listing the parties disputed constructions is attached hereto as Exhibit 1. A full listing of 3Shape's proposed constructions are further found in Exhibit 2. A full listing of 3Shape's proposed constructions is found in Exhibit 3.

The specification further explains that the 3D surface topology is represented in terms of multiple 3D points, in particular, "3D coordinate points." (*See, e.g.*, '433 patent, 3:43–46 ("the Z or depth coordinate can be associated with each spot and thus by knowing the X-Y-Z coordinates of each spot the surface topology can be generated"), 3:64–67 ("a three-dimensional (3D) numerical entity E may be crated [*sic*], comprising a plurality of coordinates (X, Y, Z) representative of the surface topology of the object being scanned.").)

The prosecution history likewise supports 3Shape's construction. In particular, during prosecution of the related '829 patent, the patentee distinguished prior art to secure allowance of the claims by noting that in the prior art, "[t]he 3D surface points on the object are not determined independently of the color information." (Ex. 12 at 16.) This prosecution history highlights that the claimed "depth data" refers to 3D surface points, and not merely any type of 3D points as Align's construction suggests. Because the intrinsic record supports 3Shape's interpretation, 3Shape's construction should be adopted.

b. Depth Data is Obtained Independently of the Color Data

The requirement that "depth data" is "obtained independently of the color data" comes directly from the patentee's clear and unambiguous statements in the prosecution history. During prosecution of a parent to the Color Scanning Patents – the '829 patent – the patentee specifically argued that in the Color Scanning Patents, "the depth data is obtained independently of the colour data" to distinguish the prior art cited by the Examiner. (Ex. 12 at 14.) In making this clear distinction over the prior art, the patentee explained that in the prior art, "[t]he 3D surface points of the object are not determined independently from the color information" and that the prior art "does **NOT** identify the surface of the object independent of the color information and then match the surface points to color information." (Ex. 12 at 16 (emphasis in original).) In fact, the patentee further explained that the prior art's approach taught away from

the invention because the prior art avoided the need to map or associate by not obtaining the depth data independently of the color data. (Ex. 12 at 15 (noting mapping or associating is not needed in prior art because depth data is obtained from color information).)

The examiner relied upon the patentee's clear distinctions over the prior art to allow the claims, noting that the prior art fails to disclose the claimed invention because it "discloses a system and method for using the color information from a series of two dimensional color images to derive the three dimensional location in space of the surface points which produced the color images." (Ex. 13 at 3.) As such, the prosecution history leaves no doubt that the claimed "depth data" needs to be "obtained independently of the color data."

These statements equally apply to the Color Scanning Patents. *See Verizon Servs. Corp. v. Vonage Holdings, Corp.*, 503 F.3d 1295, 1306 (Fed. Cir. 2007) (citing *Microsoft Corp. v. Multi-Tech Sys., Inc.*, 357 F.3d 1340, 1349 (Fed. Cir. 2004) ("a statement made by the patentee during prosecution history of a parent in the same family as the patent-in-suit can operate as a disclaimer.")). Because "depth data" appears across the Color Scanning Patent family's claims, the Court should interpret the term consistently. *See id.*

In prior ITC litigation between 3Shape and Align, the ALJ found the patentee's statements in the parent '829 patent to limit the scope of the claims in another later filed parent to the Color Scanning Patents, the '538 patent. Specifically, the ALJ determined that the patentee's clear statement that "depth data is obtained independently of colour data" was not only consistent with the specification but also limited the scope of the later filed '538 patent. (Ex. 14 at 53–54.)

The patentee's clear distinguishing statements that "depth data" is "obtained independently of the color data" is also consistent with and finds support in the specification. In particular, the specification explains that the invention obtains 3D surface points from a 3D scan,

while the color data is obtained from a 2D color scan, typically within a short time interval of each other. ('433 patent, 4:3–24.) Because the 3D surface points are obtained using a 3D scan technique and the color data is obtained using a 2D color scanning technique, the 3D surface points are obtained independently of the color data. This is illustrated, for example, by FIGS. 2A and 2B, which show the 3D surface points being obtained in one scan (FIG. 2A) and the 2D color data being obtained independently (FIG. 2B). (*See also* '433 patent, 13:46–66.) Indeed, the entire basis for the Color Scanning Patents is the purported difficulty in combining these independently obtained data sets. (*See, e.g.*, '433 patent, 1:59–2:7.)

The asserted claims of the Color Scanning Patents further establish obtaining 3D surface points independently from color data. For example, claim 1 of the '519 patent describes a "scanning system configured to provide depth data of said portion" and "an imaging system configured to provide two-dimensional color image data of said portion." ('519 patent, cl. 1.) The fact that claim 1 of the '519 patent recites two distinct systems – one for acquiring the depth data and another for acquiring the color data – further confirms that the 3D surface points are obtained independently of the color data. *See Comaper Corp. v. Antec, Inc.*, 596 F.3d 1343, 1348 (Fed. Cir. 2010) ("There is an inference, however, that two different terms used in a patent have different meanings.").

The patentee also relied upon independently obtaining 3D surface points and color data to distinguish prior art in later members of the Color Scanning Patent family. In particular, in Application No. 15/175,267 (a child to the '433 patent and parent to the '519, '151, and '152 patents), the patentee distinguished the prior art on the ground that 3D surface points and color data are obtained in a single snapshot – *i.e.* not independently of each other. (*See* Ex. 15 at 9 ("However, Decker paragraph [0031] does not disclose a time interval with respect to capturing

color and depth image data; rather, Decker discloses acquiring 'surface data in a single snapshot.'").) Again, the Examiner relied upon this distinction to allow the pending claims. (*See* Ex. 16 at 3 ("Primarily, Decker does not disclose generating the depth data separate from the color data…. Instead, Decker acquires all image data (color and depth) in a single snapshot (¶0031) wherein the color data is derive from the image data.").) The Examiner further relied upon this distinction in allowing the claims in the '519, '151, and '152 patents. (*See* Exs. 17 at 2; 18 at 3; 19 at 3.) The patentee's consistent distinction that 3D surface data must be obtained independently of the color data further supports 3Shape's construction.

Align's interpretation ignores these prior disclaimers and attempts to expand the definition of "depth data" to include color data used to derive the 3D surface points of an object. Nothing in the intrinsic record – other than the prior art that the patentee distinguished – suggests that 3D surface points can be obtained from color data. Instead, the specification and prosecution history consistently describe the invention as obtaining 3D surface points independently of the color data. Because Align's interpretation of "depth data" conflicts with its prosecution history disclaimers and the specification, it should be rejected.

2. [A.2] "scanning system configured to provide depth data of (said/the) portion" ('519 Patent, Cls. 1, 13, 24)

The intrinsic record supports 3Shape's construction of "scanning system" for the same reasons discussed above for "depth data," as the parties also dispute whether the scanning system needs to "obtain depth data independently of the color data." The '519 patent claims recite a "scanning system" to provide depth data and an "imaging system" to provide color data. (*See* '519 patent, cls. 1, 13, 24.) If the scanning system did not obtain depth data independently of the color data – *i.e.* if the scanning system could obtain depth data from the color data – it would render the imaging system superfluous. There would be no need for an imaging system to obtain

the color data as the scanning system would have already obtained it. *SimpleAir, Inc. v. Sony Ericsson Mobile Commc'ns AB*, 820 F.3d 419, 429 (Fed. Cir. 2016) ("[I]nterpretations that render some portion of the claim language superfluous are disfavored.") (citations omitted).

The specification further confirms this plain understanding from the claim structure by describing a "scanning means" for "providing depth data" and an "imaging means" for "providing two-dimensional color image data." (*See, e.g.*, '519 patent, 5:13–32.) Further, during prosecution of the parent '829 patent, the patentee explained that the "scanning means…for providing depth data" and "imaging means…for providing two-dimensional color image data" means that depth data is obtained independently of the color data. (Ex. 12 at 14.) Accordingly, the intrinsic record supports 3Shape's construction, and Align should not be permitted to recapture claim scope now. *E.I du Pont de Nemours & Co. v. Unifrax I LLC*, 921 F.3d 1060, 1070 (Fed. Cir. 2019) ("When a parent application includes statements involving 'common subject matter' with the terms at issue, those statements are relevant to construction of the terms in the child patent.") (citations omitted).

3. [A.3] "imaging system configured to provide (two-dimensional) color image data of (said/the) portion" ('519 Patent, Cls. 1, 13, 24)

3Shape's construction of "imaging system" properly reflects the prosecution history disclaimer requiring the depth data to be obtained independently of color data and that color image data requires more than a mere component of color.

a. The Imaging System Requires Colored Illumination

The prosecution history requires excluding a single color illumination source. The specification describes the "imaging system" as providing two-dimensional color image data by either illuminating the object with white light or sequential, different colored illuminations (red, green, blue). (*See, e.g.*, '519 patent, 6:37–40, 8:21–32.) As Align explained during an IPR of

the '433 patent, a parent of the '519 patent that shares a specification and similar claim terms, illumination from a source having a single color – *i.e.*, a red laser or LED – is insufficient to generate a "color" image. (Exs. 20 at 16–20; 21 at 568, 572; 23 at ¶¶ 12–14.) 3Shape's construction is consistent with Align's own disclaimer and the specification's teachings because it reflects that generating a color image requires a combination of sequential color illumination or white light, which is made from all colors of light. (*See, e.g.*, '519 patent, 13:64–67, 17:23–27, 17:38–42, 24:39–42.) To the extent Align's "plain and ordinary" construction interprets "color image data" to require only a component of color (*e.g.*, red), Align's interpretation should be rejected based not only on the specification but also Align's prior statements.

b. Color Image Data is Obtained Independently of the Depth Data

As discussed above, Align's own statements in the intrinsic record require that the color image data is obtained independently of the depth data. (*See* § I.A.1.b.) In addition, the plain language of the claims confirms this interpretation because the claimed "imaging system" for obtaining the color image data is recited as a separate limitation from the "scanning system" to obtain the depth data.

4. [A.4] "image gathering member to generate depth data of the structure portion" ('433 Patent, Cls. 1, 12)

The primary disputes with respect to this limitation are: (1) whether the term is subject to § 112 ¶ 6, and if so, the corresponding structure, and (2) if not subject to § 112 ¶ 6, whether the "imaging gathering member" needs to obtain depth data independently of color data. The second dispute is addressed above. (*See* § I.A.1, I.A.2, *supra*.) Accordingly, if the Court finds the term is not subject to means-plus-function construction, then it should adopt 3Shape's non-§ 112 ¶ 6 construction for the same reasons discussed with respect to "scanning system."

a. Image Gathering Member is Subject to § 112 ¶ 6

A POSITA[4] would not understand "image gathering member" to have sufficiently definite meaning as the name for a structure, and as such, the term is subject to § 112 ¶ 6. *See Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015). "Member" is a generic word, unassociated with any definitive structure. And the modifier "image gathering" is purely functional and not understood in the art to connote any particular structure. (Ex. 23 at ¶ 18.) Further, the claim language following "image gathering member" is purely functional – *i.e.* generating depth data of the structure portion – and does not provide any further description or insight into the structure of the "image gathering member." Thus, "image gathering member" is a means-plus-function term limited to the structures the specification explicitly describes.

b. 3Shape's Construction Correctly Identifies the Function and Corresponding Structure For the Image Gathering Member

The parties agree that the function of the "image gathering member" is "to generate depth data of the structure portion," but disagree over the corresponding structure. 3Shape's identified structure accurately captures the corresponding structure the specification describes, as § 112 ¶ 6 requires. *Williamson*, 729 F.3d at 1347 (limiting claims to description in specification).

The specification directly identifies 3Shape's proposed corresponding structure. (*See* '433 patent, 14:65–15:40, 16:39–49, FIG. 4A.) The specification exclusively describes generating depth data using at least one laser coupled to a grating or microlens array to generate an array of light beams used to determine the depth of the object. (*See* '433 patent, 14:65–15:11.) The specification further exclusively teaches the use of "telecentric confocal optics,"

[4] A POSITA would have (1) a bachelor's degree in electrical engineering, optical engineering, or physics (or equivalent course work) and two to three years of work experience in the areas of optical imaging systems and image processing, or (2) a master's degree in electrical engineering or physics (or equivalent course work) with a focus in the area of optical imaging systems and image processing. (Ex. 23 at ¶ 10.)

explaining that telecentricity is necessary to "avoid distance-introduced magnification changes," while "maintain[ing] the same magnification of the image over a wide range of distances in the Z direction." ('433 patent, 14:34–38.) The specification provides no description of how depth data can be generated from any other technique. (Ex. 23 at ¶ 25.) In fact, it was known in the art around the priority date that 3D scanning systems, particularly those using confocal scanning techniques, needed to be implemented using telecentric optics. (Exs. 23 at ¶ 23; 22 at 544 ("Three dimensional imaging can only be understood by strictly adhering to the principle of telecentricity.").) Lastly, the intrinsic record makes clear that the scanning system does not obtain color data, *i.e.* color data is obtained independently of the scanning system. (*See* '433 patent, 12:42–44 ("FIGS. 4A and 4B schematically illustrate the main elements of a portion of the invention used for providing a three dimensional monochrome entity."), FIG. 1 (illustrating separate paths for the 3D B&W (black and white, *i.e.* monochrome) data and 2D color data).) And further, the specification consistently describes that the scanning system obtains the depth data independently of the color data. (*See* § I.A.2, *supra*.) Accordingly, the construction of "image gathering member" should make clear that the structure "[d]oes not acquire color data (*i.e.* full spectrum of light required to generate color)" as 3Shape proposed.

5. [A.5] "color data of the intra-oral structure"/"color image data" ('519 Patent Cls. 1, 6, 13, 24; '151 Patent Cl. 1, 10, 18, 25; '152 Patent Cl. 9)

The primary dispute between the parties is whether the color data/color image data is obtained independently of the depth data/depth image data. For the same reasons discussed above, 3Shape's construction should be adopted. (*See* § I.A.1.b.)

Putting aside the dispute over whether the color and depth data are obtained independently, the parties agree that "color data" is "data that represents the color of the intraoral structure." While Align adds the additional limitation that the "color data" is "captured by the

sensor," it is unclear whether that limits the color data to raw image data captured by the sensor. If it does, Align's construction is incorrect because the specification describes that the color data is generated by combining multiple different colored monochromatic images together to form a full color image. (*See, e.g.*, '433 patent, 13:34–37.)

With respect to "color image data," 3Shape interpreted this phrase in the same manner as "color data." The specification does not draw a distinction between color data and color image data, and in fact, appears to use the terms interchangeably. (*See, e.g.*, '433 patent, 4:66–5:30.) Accordingly, 3Shape's construction should be adopted.

6. [A.6] "two-dimensional image data"/"two-dimensional (first/second) image data" ('433 Patent Cls. 1, 2, 12, 13)

There are two disputes with respect to these limitations: (1) whether the 2D image data is used to generate color, and (2) whether the color is generated independently of the depth data. The second dispute is the same with respect to the claimed "depth data" and should be adopted for the same reasons discussed above. (*See* § I.A.1.b.)

For the first dispute, the claims and specification confirm that the "two-dimensional image data" is used to generate color, as 3Shape proposed. In each of the asserted independent claims, the 2D image data is recited in "receive" steps that are separate from the steps to acquire depth data. (*See* '433 patent, cls. 1, 12.) Thus, properly understood in the context of the invention, this 2D image data must refer to color, as the claims and specification consistently describe the purpose of the invention as determining the surface topology (depth data) and associated color of 3D structures. (*See* '433 patent, Abstract.) Accordingly, 3Shape's construction should be adopted.

7. [A.7] "depth image data" ('151 Patent Cls. 1, 10, 18, 25; '152 Patent Cl. 9)

There are two disputes with respect to "depth image data": (1) whether it is indefinite, and (2) if not indefinite, whether it is obtained independently of the color image data. The second dispute is addressed above in "depth data." (*See* § I.A.1.b.)

As to the first dispute, depth image data is indefinite because the claims, read in light of the specification and prosecution history, "fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 910 (2014). In particular, "depth image data" appears in the independent claims of the '151 and '152 patents, which recite that this data is used to generate "depth data of the intraoral structure." Thus, according to the claim language, the "depth data" is generated from the "depth image data" and the two terms do not have the same meaning.

But the specification and prosecution history fail to provide any reasonable certainty about what "depth image data" is and particularly how it is distinct from "depth data." The specification does not even use the term "depth image data" – it only uses the term "depth data." The prosecution history likewise provides no discussion or explanation as to the meaning of "depth image data." Further, the term "depth image data" is not a term of art that a POSITA would understand with any reasonable level of certainty the scope of "depth image data." (Ex. 23 at ¶ 28.)

Align's broad interpretation of "depth data" in a prior litigation involving parents of the Color Scanning Patents further confirms "depth image data" is indefinite. In particular, in the 1091 ITC Investigation between the same parties, Align argued that "depth data" broadly "relates to data indicating depth in three dimensional space." (*See* Ex. 25 at 11.) For support, Align' expert explained that depth data includes measurements eventually used to determine depth of the object. (*See* Ex. 26 at 546:23–547:1.) Simply put, Align previously contended that "depth

data" broadly referred to any data that would be used to determine depth, which would include any image data captured by the CCD image sensor used to determine 3D depth. (*See* Ex. 25 at 11–12 (referring to Figs. 4A and 4B as illustrating "the scanning system elements that provide depth data").) Align's broad interpretation of "depth data" acknowledges that it has the same meaning as "depth image data" rendering the claims, which use both terms distinctly, indefinite.

B. [Issue B] Terms Related to Mapping of Color Data to Depth Data

All four mapping terms relate to how color and depth are mapped or associated together. The Court should adopt 3Shape's constructions because they reflect the patentee's statements defining the "present invention" as providing a particular way of mapping or associating color and depth. Both the specification's consistent description of mapping/associating in this particular way, and Align's similar descriptions of mapping/associating in the '433 patent IPR confirm the patentee's statements defining the present invention. Align's proposals of plain and ordinary meaning for the first three terms and its proposed construction for the last term all seek to recapture disclaimed claim scope and should be rejected.

1. [B.1] "map the estimated image data to the depth data for the two-dimensional reference array" ('433 Patent, Cl. 1)

The parties dispute whether (1) "map" refers to matching color values and depth data having substantially the same X-Y coordinates, and (2) "estimated image data" refers to color values. 3Shape's construction correctly reflects the intrinsic record, including the patentee's disclaimer of claim scope, and should be adopted. The Court should reject Align's proposal of plain and ordinary meaning, which seeks to recapture disclaimed claim scope.

a. Mapping Refers to Matching Color Values and Depth Data Having Substantially the Same X-Y Coordinates

The patentee's disclaimer of claim scope in both the specification and an IPR proceeding for the '433 patent supports 3Shape's construction. The patentee described mapping according

to "the present invention" as "a relatively simple and effective way for mapping 2D color information onto a 3D surface model" by directly mapping the color value at each X-Y coordinate to depth data having the same or substantially the same X-Y coordinate. ('433 patent, 4:19–43.) This is because "the present invention" obtains the 3D scan and the 2D color image typically within a short time interval and from substantially the same angle and orientation with respect to the structure resulting in "very little or no substantial distortion between the X-Y plane of the 3D scan, and the plane of the [2D color] image," such that "each X-Y point on the 2D image substantially corresponds to a similar point on the 3D scan having the same relative X-Y values." (*Id.* at 4:3–19.) Because "the same point of the structure being scanned has substantially the same X-Y coordinates in both the 2D image and the 3D scan," color values at each X-Y coordinate are directly mapped to depth data having substantially the same X-Y coordinate. (*Id.* at 4:16–24; *see also* Ex. 27 at 4–6 (confirming that the present invention maps color values to depth at the same or substantially the same X-Y coordinate).) Align similarly provided the same mapping description in an IPR proceeding for the '433 patent. (Ex. 20 at 5–7, 9–10, 14–15.) 3Shape's construction should therefore be adopted because it reflects the patentee's disclaimer of claim scope in the specification's description of the "present invention." *See Honeywell Int'l, Inc. v. ITT Indus.*, 452 F.3d 1312, 1318 (Fed. Cir. 2006).

The consistent descriptions of mapping in the remainder of the specification likewise confirm that the described way of mapping is not merely a preferred embodiment. *See id.* For example, FIG. 2C illustrates the mapping of the color data to depth data by matching corresponding X-Y coordinates. In particular, a processor maps the 2D color data – represented by the entity N with a color value C and coordinates X'-Y' – to depth data with substantially the same X-Y coordinates, which entity E with coordinates X, Y, Z represents . (*See* '433 patent,

FIGS. 2A–C, 13:46–14:16.) The specification does not describe or contemplate mapping of color values to depth data in any other way. As such, 3Shape's construction correctly reflects the scope of the claimed mapping as described in the specification. (*See id.* at 8:54–61, 13:41–14:55.)

Align described the claimed invention the exact same way in an IPR proceeding for the '433 patent. Align equated "map" with "match," explaining that to "'map the [two-dimensional] image data to the depth data' would require the 'one or more processors configured to cause a system to at least' **match or link** the claimed 'two-dimensional image data' to the claimed 'depth data.'" (*See* Ex. 20 at 14 (emphasis in original); *see also* '433 patent, 25:43–46.) As such, the intrinsic record further confirms 3Shape's construction.

b. Estimated Image Data Refers to Estimated Color Values

The patentee's description of the "present invention" as mapping color values to depth data likewise informs the meaning of "estimated image data." In particular, claim 1 recites mapping "estimated image data" to depth data. ('433 patent, 26:48–49.) But the specification, including the patentee's description of the present invention, only describes mapping color values to depth data. (*Id.* at 4:19–40, 13:41–44, 14:11–55.) Likewise, the specification only describes mapping estimated color values to depth data. (*Id.* at 11:32–40.) As the patentee's statements and the specification's disclosures equate estimated image data to estimated color values, the intrinsic record confirms 3Shape's construction.

2. [B.2] "selectively map the image data to the depth data for the two-dimensional reference array based on the plurality of focal lengths and the depth data such that the resulting associated color of the structure portion is in focus relative to the structure portion for a plurality of distances in the depth direction" ('433 Patent, Cl. 12)

The parties dispute whether: (1) "selectively map" refers to selectively matching color values and depth data having substantially the same X-Y coordinates, and (2) the "resulting

associated color of the structure portion is in focus" refers to the "entire wavelength component of color is in focus." The Court should adopt 3Shape's construction, which correctly reflects the intrinsic record. As with the above "map" term, Align's proposal of plain and ordinary meaning seeks to recapture disclaimed claim scope and should be rejected.

The claimed mapping here also refers to matching color values at X-Y coordinates to substantially the same X-Y coordinates of the depth data. (*See* § I.B.1, *supra*.) Addition of "selectively" does not change the core meaning of "map," other than to indicate that this X-Y coordinate matching occurs according to the rest of the limitation – *i.e.*, "based on the plurality of focal lengths and the depth data such that the resulting associated color of the structure portion is in focus relative to the structure portion for a plurality of distances in the depth direction." (*See, e.g.*, Ex. 20 at 13–14.) As such, "selectively map the image data to the depth data for the two-dimensional reference array" should be construed as "selectively match color values at X-Y coordinates to substantially the same X-Y coordinates of the depth data" for the same reasons discussed above. (*See* § I.B.1, *supra*.)

Next, the intrinsic record confirms that the "resulting associated color of the structure portion is in focus" means that the entire wavelength composition of color is in focus. In an IPR on the same patent, Align argued that "associated color" cannot be a single wavelength or color component. (*See* Ex. 20 at 18.) Instead, Align and its expert stated that the "associated color" must include the entire wavelength composition of color. (Ex. 28 at ¶¶ 190–91 (associated color includes "light in each of the different monochromatic colored illuminations" reflected from the object).) Based on Align's arguments, the Board agreed that "associated color" means "the entire wavelength composition of light reflected by an object." (Ex. 27 at 18, 22.) As such, "the

resulting associated color…is in focus" should have the same meaning here – *i.e.*, "the entire wavelength composition of color…is in focus."

3. [B.3] "processor...configured to associate the depth data with the two-dimensional color image data" ('519 Patent, Cls. 1, 13)

Similar to the "map" and "selectively map" terms above, the parties dispute whether "associating" the depth data with the 2D color image data requires matching depth data at X-Y coordinates to 2D color image data with the same or substantially the same X-Y coordinates. (*See* §§ I.B.1, I.B.2, *supra*.) Because the specification equates "associate" with mapping/matching, "associate" should be given the same claim scope as "map," as 3Shape's construction reflects. (*See* '433 patent, 11:32–37, 51–55; *see also* 2:2, 8:54–61.) Likewise, Align confirmed in an IPR of the '433 patent that "associate" refers to mapping or matching color to depth data based on the same or similar X-Y coordinates, as FIG. 2C illustrates. (Ex. 29 at 6–8.) The intrinsic evidence therefore confirms 3Shape's construction, whereas Align's proposal of plain and ordinary meaning seeks to recapture disclaimed claim scope and should be rejected.

4. [B.4] "(color) three-dimensional numerical entity" ('151 Patent, Cls. 1, 10, 11, 18, 25; '152 Patent, Cls. 1, 9, 23)

The parties appear to agree that the numerical entity is created – *i.e.*, is new – by mapping, matching, or associating coordinates of depth and color data. (*See also* Ex. 20 at 7, 15 (confirming that matching color and depth creates new data).) But the parties dispute whether: (1) the color and depth must be matched at substantially the same X-Y coordinates and (2) the depth data is independently obtained from the color data.

As explained above for the "map," "selectively map," and "associate" terms, the intrinsic record confirms that color and depth are mapped, matched, or associated using the same or substantially the same X-Y coordinates. (*See* §§ I.B.1, I.B.2, I.B.3, *supra*.) For example, the

specification describes directly mapping color values at each X-Y coordinate to depth data having the same X-Y coordinate to create a "numerical entity I representing the color and surface topology." ('433 patent, 4:19–24.) Likewise, Align consistently described mapping, matching, or associating color and depth data having the same or substantially the same X-Y coordinates in the '433 patent IPR. (*See* Ex. 20 at 5–7, 15.) As such, the intrinsic record confirms that matching the color and depth data having the same or similar X-Y coordinates creates the "(color) three-dimensional numerical entity," as reflected in 3Shape's construction. Align's proposed construction, which does refer mapping, matching, or associating based on the same or similar X-Y coordinates, seeks to recapture disclaimed claim scope and should be rejected.

The parties also dispute whether the color data must be independently obtained from depth data. As discussed above for the "depth data" and its related terms, the intrinsic record confirms 3Shape's construction. (*See* § I.A, *supra*.)

C. [Issue C] Terms Relating to Light/Light Beams

1. [C.1] "illumination unit configured to transmit a first array of incident light along a path towards the three-dimensional structure" ('519 Patent, Cls. 1, 13, 24)

The claims of the '519 patent are indefinite because the claimed "array of incident light," when read in light of the specification and prospection history, fails to inform a POSITA with reasonable certainty about the scope of the claim term or *how and with what* the "array" is transmitted. The term "array of incident light" does not have a defined meaning and is unclear to the POSITA. (Ex. 23 at ¶¶ 34-35.)

This ambiguity arises because Align's claims are a product of its failures to prove 3Shape's infringement in prior litigation before the ITC. (Ex. 37 at 66 (finding that 3Shape's products did not "generate a plurality of incident light beams").) To avoid a similar fate, Align recycled claim language from its earlier patents in the '519 patent asserted here – while

strategically removing the term "beams" from the claims thereby rendering the claimed "array of incident light" term meaningless both from a plain and ordinary meaning perspective and in light of the specification. (Ex. 23 at ¶¶ 34–37.)

While the specification refers to the term "array of incident light *beams*" and provides a description of how a laser source optically coupled to a grating or microlens array may transmit an array of such incident light *beams* it contains no description, explanation, or definition of the term "array of incident light." (Ex. 23 at ¶ 37.) Beams are collimated light capable of forming an array of spots on an illuminated object; uncollimated light, on the other hand, cannot form an array. (Ex. 23 at ¶ 36.)

Inconsistencies amongst the dependent claims further demonstrate the ambiguity Align introduces in its attempt to jettison the "beam" language from its independent claims. For example, various dependent claims refer to "*the* light beams" and "*an* array of incident light beams." (Ex. 23 at Ex. 23 at ¶ 38.) There are too many variations in the claims of the '519 patent to discern whether the patentee intended these terms to refer to the same "array of incident light" element of the independent claims or to one or more discrete elements, rendering the scope of the invention unclear. (Ex. 23 at ¶¶ 37–39.)

Align's proposed construction of "illumination unit" compounds, rather than clarifies, the ambiguities surrounding the claimed "array of incident light." The term "unit" is a nonce term that is "tantamount to using the word means," and the term "illumination unit" does not bring to mind any specific structure to the POSITA. *Williamson*, 792 F.3d at 1350. (Ex. 23 at ¶¶ 40-41.) Align's proposed constructions of "illumination unit" demonstrates the generic, non-structural nature of "illumination unit" and highlights that the term is insufficient "to connote a specific structure or class of structures." *See, e.g.*, *MTD Products v. Iancu*, 933 F.3d 1336, 1340 (Fed.

Cir. 2019). Both of Align's proposed constructions fail to specify whether the illumination unit itself includes a light source and what, if anything, is required in addition to (or instead of) a light source to transmit an "array of incident light." The functional nature of Align's "illumination unit" constructions (*e.g.*, "one or more optical elements that provide or condition light for illumination") further highlight the lack of sufficiently definite structure for the term "illumination unit" and thus, shed no light on the structural metes and bounds of the ambiguous "array of incident light." (Ex. 23 at ¶¶ 40-41.) Moreover, nothing in the claims provides context as to how, if at all, the "illumination unit" interacts with the remainder of the claimed system components (*i.e.*, the scanning system, imaging system, detector, or processor) in a way that would inform the structural character of the "illumination unit" such that a POSITA would be able to ascertain the meaning of "array of incident light" with reasonable particularity. *See, e.g.*, *Williamson*, 792 F.3d at 1351; (Ex. 23 at ¶ 41).

Accordingly, the claimed "array of incident light" and thus, "illumination unit" are indefinite. If the Court disagrees, it should adopt 3Shape's proposed construction, which provides objective boundaries as to the scope of the claimed "illumination unit" (*i.e.*, to require a structure: laser(s) optically coupled to a grating or microlens array which functions to: transmit incident light along a path towards a three-dimensional structure to form an array of spots").

2. [C.2] "detector (configured) to measure intensity of each of a plurality of returned light"/"measure intensity"/"returning light" ('519 Patent Cls. 1, 4, 13, 24, 30; '151 Patent Cls. 10, 25)

The claims of the '519 patent are indefinite because they fail to convey the meaning of "each of a plurality of returned light" in a way that would allow a POSITA to understand with reasonable certainty what constitutes a "plurality of returned light" or how a detector could be configured to measure the intensity of "each" such plurality. (Ex. 23 at ¶¶ 42–43.) Much like the "array of incident light" limitation, Align's intentional omission of the word "beam" from the

independent claims, but the inclusion of such terms in dependent claims amplifies the claim's confusing nature. (*See*, *e.g.*, '519 patent, 28:47–49, 29:19–22, 29:36–40; Ex. 23 at ¶ 44.)

And similar to the illumination unit, the detector of the claims is untethered to the scanning system, the imaging system, the illumination unit or the processor. That is, the claim itself fails to provide any context as to how the "detector" functions within the claimed system in a way that offers clarity to the meaning of "each of a plurality of returned light." (Ex. 23 at ¶¶ 45–46.)

Accordingly, the claims are indefinite. Alternatively, the detector limitation must be construed to cover a detector configured to measure intensity of light returning from each illuminated spot on an object consistent with the only algorithm described in the specification for determining depth data and Align's prior interpretation of claims.

3. [C.3] "light beams"/"incident light beams"/"returned light beams" ('519 Patent Cls. 20, 21; '151 Patent Cls. 1, 18)

The parties appear to agree regarding the construction of "light beams." 3Shape construed "light beams" as "more than one direction projection of light energy," while Align construed "light beams" as "directional projections of light energy." (*See* Ex. 1 at 6.) Based on these constructions, the parties appear to agree that light beams requires more than one directional projection of light energy.

3Shape's constructions of the "incident light beams" and "returned light beams" properly reflect their meaning in light of the specification. In particular, the specification consistently describes the "incident light beams" and "returned light beams" in connection with illuminated spots on an object. (*See, e.g.*, '519 Patent, 3:21-27, 3:55-4:17, 9:36-58, 16:15-30.) The specification does not describe or contemplate the incident light beams or returned light beams as forming or being returned from anything else other than an illuminated spot.

Further, the only algorithm the specification describes for determining 3D surface topology relies upon light beams which form illuminated spots on the surface of an object and light beams that return from each of those illuminated spots. (*See* '519 patent, 5:67–6:5.) The specification does not describe or contemplate, for example, the determining of 3D surface topology other than by determining the intensity of the illuminated spots. (*Id.* at 16:15-30.) Accordingly, the proper construction of "incident light beams" and "returned light beams" in light of the specification requires "illuminated spots," and as such, 3Shape's construction should be adopted.

D. [Issue D] Terms Relating to Focusing

1. [D.1] "focal plane" ('151 Patent Cls. 1, 10, 18; '151 Patent Cls. 1, 9, 16, 23)

The dispute is whether a "focal plane" refers to an "X-Y plane parallel to the image sensor" (3Shape) or "a position where one or more light beams from the optical system are focused" (Align).

The intrinsic record is consistent with and supports 3Shape's construction of "focal plane" as an "X-Y plane parallel to the image sensor." The specification describes that the focal plane is used to determine the depth, or the "Z-value," along an X-Y plane. ('151 patent, 4:12–14 ("Thus, in each case, a Z-value is obtained for each point along an X-Y grid representing a plurality of light beams.").) In particular, the specification describes that the depth is determined by identifying for each X-Y position along the X-Y plane where the corresponding light beam is in-focus along the Z-axis. ('151 patent, 16:15–17 ("Incident light beams 48 form an array of light beams arranged in an X-Y plane, in the Cartesian frame propagating along the Z-axis.").) The focal plane is traversed along the z-axis such that the light beams can be focused to different depths. (*See* '151 patent, 16:25–30.)

The specification further explains that the focal plane is substantially parallel to the image sensor. ('151 patent, 14:8–10 ("The X-Y plane of entity E is substantially parallel to the sensing face of the image sensing means of the detection optics 60, typically a CCD.").) This is illustrated, for example, in FIG. 5B which shows light beams focusing on an X-Y plane orthogonal to the depth direction and thus parallel to the image sensor. ('151 patent, FIG. 5B, 17:52 ("the light rays focus on focusing plane 101").) Because the "image sensor… typically defines the X-Y frame of reference" and because the focal plane is orthogonal to the light propagating along the Z axis, the focal plane and the image sensor are substantially parallel. ('151 patent, 13:42–44.)

Align's expert in an IPR proceeding on a parent in the Color Scanning Patent family, Mr. Aikens, further confirmed that the focal plane is an X-Y plane parallel to the image sensor. Specifically, Mr. Aikens explains that in Babayoff '415, which is the same confocal imaging system described in the Color Scanning Patents (*see* '151 patent, 15:14–20), states that the Babayoff '415 scanning system optics "must form a flat surface without image curvature or other deviations" – meaning that the focal plane is parallel to the image sensor. (Ex. 30 at ¶ 183.) As Mr. Aikens explains, this is accomplished using optics to correct for any distortions at the focal plane that cause the focal plane to curve, thereby rendering it not parallel to the image sensor. (*Id.* at ¶ 185.) Accordingly, Align's own expert testimony confirms 3Shape's construction. Later-filed Align patents that specifically describe a confocal imaging system that is able to image non-parallel focal surfaces, (*e.g.*, curved focal surfaces) further confirm that the Color Scanning Patents do not contemplate that the focal plane is non-parallel to the image sensor. (*See, e.g.*, Ex. 24 at 9:49-51); *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1334 (Fed. Cir. 2003) ("unless otherwise compelled…the same claim term in the same patent or related patents

carries the same construed meaning."); *see also In re Rambus Inc.*, 694 F.3d 42, 48 (Fed. Cir. 2012).

Align's proposed construction, is overbroad and not based on the plain meaning of the term. Align improperly removes the term "plane" from the claims, instead defining "focal plane" as a "position." The specification consistently uses "position" to define the Z or depth value of an "illuminated spot," so Align's construction reduces "focal plane" to a single point. (*See, e.g.*, '151 patent, 3:36–52.) A point cannot be parallel to a plane. Likewise, a position where one light beam is focused cannot be parallel to the X-Y plane defined by the image sensor. Accordingly, Align's construction is overbroad, and should be rejected.

2. [D.2] "focusing optics" ('151 Patent Cls. 1, 10, 18, 25; '151 Patent Cls. 1, 9, 16, 23)

There are two disputes regarding the claimed "focusing optics": (1) whether the focusing optics operate telecentrically, and (2) whether the focal plane that the focusing optics define focal surface parallel to the image sensor. Section I.D.1I.D.1, above, addresses the second dispute.

As to the first dispute, the specification describes the use of "telecentric confocal optics" for the purpose of "avoid[ing] distance-introduced magnification changes" while "maintain[ing] the same magnification of the image over a wide range of distances in the Z direction." ('151 patent, 15:59–61.) While the specification notes that focusing optics are "typically" operated in a telecentric mode ('151 patent, 15:55–56), nothing suggests that the specification discloses the use of non-telecentric focusing optics. (*See* § I.A.4, *supra*.) The fact that another Align patent family that describes a confocal optical system specifically configured to determine depth using non-telecentric optics confirms the Color Scanning Patent family does not disclose non-telecentric optics. (*See* Ex. 24 at 9:53–57 ("…the confocal imaging apparatus operates in a non-

telecentric mode, and magnification at a focal plane changes with changes in focusing settings of the confocal imaging apparatus.").)

Align's expert from an IPR proceeding on a parent in the Color Scanning Patent family, Dr. Sonka, further confirms 3Shape's construction because he equates the focusing optics with the telecentric confocal optics described in the specification. (Ex. 28 at ¶ 135 ("'focusing optics,' (e.g., telecentric-main confocal optics 42)").) Neither the specification nor Dr. Sonka describe any alternative non-telecentric embodiment of the focusing optics.

E. [Issue E] Terms Relating to Reference Array

1. [E.1] "two-dimensional reference array substantially orthogonal to a depth direction" ('433 Patent Cls. 1, 12)

The dispute is whether a "two-dimensional reference array" refers to an "array of points in an X-Y plane" (3Shape) or a "reference plane" (Align). The parties, however, agree that "substantially orthogonal to a depth direction" means "substantially 90 degrees to a depth direction."

The intrinsic record supports and is consistent with 3Shape's construction of "two-dimensional reference array" as "array of points in an X-Y plane." The specification describes the reference array as an array of points in an X-Y plane. (*See, e.g.*, '433 patent, 13:14–19 ("provide depth Z values for an array range of X-Y points (according to a known frame of reference)…"), 13:47–54 ("A three-dimensional numerical entity E is obtained by determining depth Z-values for a grid of X-Y points…The X-Y plane of entity E is substantially parallel to the sensing face of the image sensing means of the detections optics 60, typically CCD.").) The specification further explains that this X-Y plane is used to as a reference for mapping color image data to the depth data. (*See, e.g.*, '433 Patent, cl. 1 ("…map the estimated image data to the depth data for the two-dimensional reference array…"), 13:41–14:16.)

3Shape's definition is further consistent with the claims, which require that the two-dimensional reference array be substantially orthogonal to a depth direction. The specification defines the depth direction as the "Z" direction. In standard coordinate systems understood in the art, the X-Y plane is orthogonal to the Z direction. Accordingly, the "two-dimensional reference array" should be construed to refer to an "array of points in an X-Y plane." ('433 patent, 14:26–27 ("the depth direction (Z)").)

The Court should reject Align's construction, "reference plane," because it is vague as to what it means by "reference plane" because the specification does not use the term "reference plane." By contrast, the specification directly supports 3Shape's construction. It should therefore be adopted.

2. [E.2] "depth data corresponding to a plurality of data points defined on a plane substantially orthogonal to a depth direction" ('519 Patent Cls. 1, 13, 24)

The parties agree that "substantially orthogonal to a depth direction" means "substantially 90 degrees to a depth direction," but dispute whether a "plurality of data points defined on a plane" refers to an "array of points in an X-Y plane" (3Shape) or a "plurality of points on a reference plane" (Align). For the same reasons discussed above with respect to "two-dimensional reference array," the intrinsic record supports and is consistent with 3Shape's construction. (*See* § I.E.1 *supra*.) Indeed, the specification uses the term "plurality of data points" only once, in the context of the above construed "two-dimensional reference array." ('519 patent, 9:9.) Accordingly, for this reason and the reasons set forth in § I.E.1, the Court should reject Align's vague construction and adopt 3Shape's.

F. Agreed Upon Constructions

The parties have agreed upon the construction of "confocal imaging techniques" as "imaging technique having illumination and detection paths with conjugate focal planes." (Ex. 2 at 5; Ex. 3 at 6.)

II. SELECTIVE RESCANNING PATENTS

Each of the Selective Rescanning Patents has the same specification and claims priority to the same provisional application. (*Compare* '936 patent; '609 patent; *see also* Ex. 31.) They are generally directed to a system and method for creating 3D virtual models after "scanning the previously obscured part of the dental surfaces of the patent's teeth and the non-obscured tooth surfaces." ('936 patent, Abstract.) The patents teach that issues may arise in scanning a patient's intraoral cavity if something is obscuring part of the intraoral cavity. (*Id.* at 1:60–2:22.) The claimed inventions in the patents allegedly address these issues by allowing for selective rescanning of intraoral structures.

A. [Issue F] Deleting, Removing, or Discarding Portions of a Model

1. "remove, from the displayed model, a removed surface portion of the model to be removed according to the user input" ('936 Patent, Cls. 1, 17)[5]

During the meet and confer process, Align did not agree that 3Shape's proposed construction provides the plain and ordinary meaning of the claim term. However, while

[5] Other terms related to this issue include: "discard [discarding] a remainder of the [received] second scan data" ('936 patent, cls. 7, 17; '609 patent, cls. 19, 23); "removing [remove] or deleting [delete] at least the surface data representative of the first surface portion" ('609 patent, cl. 20); "removing at least the surface data representative of the first surface portion having the first surface topology and replacing at least a portion of the removed surface portion using at least a portion of the received second scan data" (*id.*, cl. 23). 3Shape expects that the Court's decision regarding this exemplary term will moot outstanding disputes concerning terms related to this issue, such that these terms do not need to be briefed separately.

disputing that 3Shape's construction properly defines the scope of the limitation, Align presents no alternative, nor did it explain why 3Shape's construction is inconsistent with the plain and ordinary meaning. Consequently there is a dispute as to claim scope, requiring a construction clarifying the meaning of the limitation is necessary. *O2 Micro Int'l Ltd. V. Beyond Innovation Tech Co.*, 521 F.3d. 1351, 1361 (Fed. Cir. 2008).

The patent specification consistently describes "remove," "delete," and "replace" as part of a single operation. (*See*, *e.g.*, '936 patent, 4:31–32, 5:8, 8:21–22, 11:5, 11:45–50, FIG. 9.) The '936 patent specification discloses the removal, deletion, or replacing operation in two claim limitations: (1) the instant limitation, and (2) the "replace at least a portion…" limitation. (*See* § II.C, *infra*.)

The Court should adopt 3Shape's proposed construction because the instant claim limitation corresponds to both the "remove" and "delete" disclosures, which the '936 patent treats synonymously and interchangeably. (*See*, *e.g.*, '936 patent, 22:9, 22:21, 14:55, 15:61, 21:40–44.) In fact, the specification expressly provides that the "delete" function is "also referred to interchangeably herein as a remove function, remove command, or deleted command…" (*Id.* at 24:57–59.) This repeated and consistent use of the terms as interchangeable evinces the patent drafter's intent to treat these terms as having the same meaning and scope. *Wasica Fin. GmbH v. Cont'l Auto. Sys.*, 853 F.3d 1272, 1282 (Fed. Cir. 2010). Therefore, to the extent that Align argues that this term should be construed to include any scope beyond deletion, the specification's disclosures do not support that additional scope.

3Shape's proposed construction is also appropriate at least because "delete" is an easily understood, common term used in the field of computer algorithms and software, and has a clear,

well understood meaning to a POSITA. (Ex. 36 at ¶¶ 18, 11–13.)[6] By contrast, "remove" does not clearly convey a computer operation, but rather has meaning only by analogy to a physical model. (*Id.* at ¶ 19.) Given the '936 patent's interchangeable use of "remove" and "delete," the Court should adopt a construction that provides a clear claim scope.

B. [Issue G] The Scope of a Physically Changed Intraoral Portion

1. [G.1] "a physically changed portion of the patient's intraoral cavity" ('936 Patent, Cls. 1, 9)[7]

During the meet and confer process, Align did not agree that 3Shape's proposed construction provides the plain and ordinary meaning of the claim term. The '936 patent's Notice of Allowance and specification confirm that this claim term requires that an intraoral portion is physically altered by a dental practitioner. Specifically, in the '936 patent's Notice of Allowance, the examiner provides: "[t]he claims as recited distinguish over the art of record, and the art as a whole via reciting the updating scans to be directed to scenarios where the intra-oral cavity (e.g. dentition) is modified in between the scans (e.g. *subjected to a surface preparation*)." (Ex. 32 at 2.) The examiner also explained that the claims were allowed because the closest prior art "does not provide for (or suggest) generating a composite scan after *intra-oral modifications* are made." (*Id.*) Align's proposed plain and ordinary meaning does not account for these distinctions made over the prior art.

[6] 3Shape's definition of the level of ordinary skill in the art is recited in Dr. Mellor's declaration.

[7] "The first surface portion having a first physical shape and the second scan data comprises data of the first surface portion having a second physical shape" ('609 patent, cl. 15) is another term related to this issue. 3Shape expects that the Court's decision regarding this exemplary term will moot outstanding disputes concerning terms related to this issue, such that these terms do not need to be briefed separately.

Further, in a related application, the examiner "noted that highlighting the feature of composite scan updates following modification to the dentition, *e.g. after a removal operation was done on a tooth*, appeared distinct from the noise/error correction rescans disclosed by the prior art." (Ex. 34 at 9.) Thus, the patent examiner viewed the claims as requiring a physical change to the teeth, such as by a surface preparation or removal operation, to distinguish over the prior art. Both a surface preparation or removal operation are performed by a dental practitioner.

The '936 patent specification further demonstrates this claim term requires action by a dental practitioner. (*See*, *e.g.*, '936 patent, 2:51–59.) The patent is directed to systems and methods "for preparation of orthodontics and prosthodontics," or dental procedures performed by a dental practitioner; it is a dental practitioner who may interact with a dental patient during the course of a dental treatment or "may be involved in determining, preparing, or providing dental treatment to a patient, particularly prosthodontic treatment and/or orthodontic treatment." (*Id.*)

The '936 patent also teaches that at least a part of a surface of interest "is inadequate for enabling a prosthesis to be mounted with respect thereto" and the surface of interest is physically altered by, for example, "a material removal operation wherein to modify the topology of said at least a part of said surface of interest." (*Id.* at 5:60–6:12; *see also id.* at 9:9–29, 16:22–55, 27:23–28, 27:60–65 (each describing actions by a dental practitioner to enact a physical change).) A material removal operation is something that a dental practitioner performs. For example, the '936 patent explains that a dental practitioner can physically change an intraoral portion of an orthodontic patient if "it is determined that the treatment may be improved by removing or filing some teeth." (*Id.* at 16:56–17:3.) Therefore, "a physically changed portion of the patient's intraoral cavity" means "an intraoral portion physically altered by a dental practitioner."

2. [G.2] "accounting for changes in surface topology when [intraorally] scanning a patient's teeth for a dental procedure" ('609 Patent, Cls. 1, 12, 23)

The Court should adopt 3Shape's construction because the preambles of claims 1, 12, and 23 are limiting. Preambles of claim terms are generally not considered to be limiting. *Aspex Eyewear, Inc. v. Marchon Eyewear, Inc.*, 672 F.3d 1335, 1347 (Fed. Cir. 2012). However, "[c]lear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention." *Catalina Mktg. Int'l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808–09 (Fed. Cir. 2002). As discussed, the applicant for the '936 patent relied on the changes in surface topology recited in the preamble to distinguish the claimed invention from the prior art. (*See* § II.B.1., *supra*.) The examiner granted the '609 patent for similar reasons as the '936 patent. (*Compare* Exs. 32, 33.) That is, the examiner granted the '609 patent (and the '936 patent) because the closest prior art "does not provide for (or suggest) generating a composite scan after *intra-oral modifications* are made." (Ex. 33 at 2.) Accordingly, this claim term is limiting.

The specification further confirms a dental practitioner accounts for changes in surface topology. For example, the '609 patent teaches "a material removal operation wherein to modify the topology of said at least a part of said surface of interest." ('609 patent, 6:4–24.) A material removal operation done on a tooth changes its surface topology. For the reasons discussed above, a dental practitioner creates these changes in surface topology. (*See* § II.B.1, *supra*.)

C. [Issue H] The Meaning of Replacing or Updating a Virtual Model

1. [H.1] "replace [replacing] at least a portion of the [removed] surface portion of the model […] using the received second

scan data [at least a portion of the second scan data]" ('936 Patent, Cls. 1, 9, 17) [8]

The '936 patent specification does not disclose what steps or techniques, if any, are involved in "replac[ing]" beyond disclosing that the second scan data is registered to the model. For example, FIG. 1 only discloses "registering …" as the step following the acquisition of the second 3D virtual model. ('936 patent, FIG 1.) As such, where the delete/remove step is separated from the replace step, the replace step should be interpreted to mean registering. Furthermore, even where the specification repeats the claim language of "replacing," that replacing disclosure describes that the replacing is accomplished by registering, and does not describe any further elements or aspects of "replacing." (*See, e.g.* '936 patent, 4:44–50, 22:61–66, 7:50–8:3, 27:35–39, 26:29–34, 11:18–24.) Accordingly, to avoid inappropriately expanding the claim scope beyond what is actually disclosed in the patent, and thus rendering the claim invalid, the replacing terms should be construed as 3Shape has proposed, *i.e.*, coextensive with the patent's disclosure. *See Eastman Kodak Co. v. Goodyear Tire & Rubber Co.*, 114 F.3d 1547, 1556 (Fed. Cir. 1997) (claim terms should be construed to preserve validity).

In addition, 3Shape's proposed construction is appropriate because a POSITA would have understood that registration of the second scan data with the retained portion is necessary to replacing the former into the latter. (Ex. 36 at ¶¶ 21–23.) This is because the second scan data must be placed into the same coordinate system as the retained portion, and to do that a

[8] Other terms related to this issue include: "register [registering] the second scan data with the model" ('936 patent, cls. 4, 17); "register the second scan data with the model by aligning identifying data of the second scan data with corresponding parts of the model" (*id.*, cl. 5, 17; '609 patent, cls. 17, 21, 23). 3Shape expects that the Court's decision regarding this exemplary term will moot outstanding disputes concerning terms related to this issue, such that these terms do not need to be briefed separately.

correspondence must be determined between the native coordinate system of the second scan and the desired end coordinate system common to both data sets. (*Id.*)

Align's improper construction attempts to capture claim scope that the patent neither discloses nor enables. The specification never suggests that "replacing" means "use instead of." In fact, the word "instead" only appears twice in the specification; it is not used to describe or define the claimed "replacing" in either instance. ('936 patent, 23:18, 27:53.) As such, because claim construction must be based on a term's use in the context of the specification, the Court should reject Align's proposed construction. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313–14 (Fed. Cir. 2005).

2. [H.2] "updating [update] the first model by modifying only at least a portion of the surface data [first surface portion]" ('609 Patent. Cls. 1, 12, 23)

This claim term fails to "inform those skilled in the art about the scope of the invention with reasonable certainty" and is indefinite. *Nautilus*, 572 U.S. at 910. The '609 patent provides no indication as to the scope of the claim language "only at least a portion." For example, the independent claims of the '609 patent merely mention "modifying only at least a portion of the surface data," but do not provide any further limitations to shed light on what constitutes "only at least a portion of the surface data." ('609 patent, cl. 1.) This failure creates a problem for a POSITA attempting to understand this limitation because the inclusive language "at least" appears to directly contradict the exclusive word "only." The conjunction of these two contradictory terms prevents a POSITA from ascertaining the scope of the invention. (Ex. 36 at ¶ 25.) The specification likewise fails to provide guidance. In fact, it does not mention "only at least a portion" anywhere. Thus, this claim is indefinite.

D. [Issue I] The Meaning of User Input Identifying Portions of a Model

1. "receiving [receive] user input, via the displayed first model, demarcating the surface data representative of the first surface portion and the surface data representative of the second surface portion" ('609 Patent, Cls. 1, 12)

The Court should apply the plain and ordinary meaning of this claim term. Align's proposed construction overcomplicates the term and omits or makes the required step "demarcating…the surface data representative of the second surface portion" optional. The plain meaning of this term explicitly requires user input that demarcates data representative of the first and second surface portions. The '609 patent teaches marking a part of the model. ('609 patent, 21:26–37.) "By 'marked' it is meant that this zone or area of the first image DI1 is at least identified by the user, and may optionally include interacting with the display 33 so that a visual mark is included in the image to show and demarcate this area on the image DI1 that is on the display 33." (*Id.*) The '609 patent teaches that the user can use a wand "for interacting with the display 33, wherein a visual mark is displayed wherever the tip 39 of the wand 34 touches the image DI1 on the display 33." (*Id.*) Given these teachings, this term plainly requires user input demarcating the surface data representative of the second surface portion by marking it in some way because the user explicitly marks with a visual mark the first "zone or area"; it is not "implicitly" marked, as Align proposes. Taken together, these teachings show that this term requires user input demarcating the surface data representative of the second surface portion.

III. HOLE CLOSING PATENT

The '527 patent generally describes a method and system for replacing a missing portion of a dental structure in a 3D virtual dental model. (*See* '527 patent, Abstract.) The '527 patent focuses on obtaining a 3D virtual model of a tooth preparation to properly design a tooth crown. (*See id.* at 1:46–2:16.) The '527 patent purports to correct for lack of sufficient finish line data

of the tooth problem by separating the virtual model into two parts, generating additional data to replace the missing portion in one model part, and combining the new data and the original model to create a virtual model showing the obscured portion. (*See id.* at 7:33–40, 9:4–11:53, FIGS. 1, 4, 5, 8.) FIG. 1 details the workflow to separate the original virtual model into two parts, identify missing portions of the finish line, create a third model part by extrapolating data to replace the missing data, and combine the models. (*See id.* at FIG. 1.) The '527 patent then provides for creating a prosthesis (*e.g.*, a crown or bridge) based on the combined virtual model (*i.e.*, with a "fully defined" finish line). (*See id.* at 6:6–15, 11:38–59.)

A. [Issue J] Determining a Missing Portion of the Intraoral Structure

1. "determining [determine] a missing portion of the 3D virtual model that are missing a portion of the intraoral structure of the patient" ('527 Patent, Cls. 1, 12)

The Court should construe this term as "determining a missing dental structure in the 3D virtual model" because it accurately reflects the intrinsic record, captures the '527 patent's disclosures, and reflects the intended claim meaning. *See Phillips*, 415 F.3d at 1316. In particular, the specification explains that gum tissue, blood, or saliva may obscure "parts of the finish line, and possibly also the shoulder and other parts of the preparation." (*See* '527 patent, 2:4–6.) It then explains "[t]he present invention is particularly applicable to situations in which at least a part of the finish line S and possibly a part of the should T is obscured by other material 550,…[so that] the virtual model 500 obtained by the scanning process lacks finish line data." (*Id.* at 7:33–39.) The '527 patent then walks through the process of FIG. 1, which allows for the creation and subsequent combination of two model parts (*see id.* at 7:41–11:53) to form a new virtual model 590 "in which the finish line S, emerging profile P, gum line G and preparation P are now fully defined." (*Id.* at 11:51–53.) 3Shape's construction reflects the disclosed process of replacing a missing *dental structure*.

3Shape's proposed construction is also logical and easily understood. For example, a jury can readily understand "the intraoral structure of the patient" as a "dental structure." *See Funai Elec. Co. v. Daewoo Elecs. Corp.*, 616 F.3d 1357, 1366 (Fed. Cir. 2010) ("The criterion is whether the explanation aids the court and the jury in understanding the term as it is used in the claimed invention."). Align's construction, on the other hand, injects ambiguity because it uses the term "a portion" in two different places ("determining a portion of the 3D virtual model that is missing a portion…"), rendering it unclear as to whether these portions are the same. Align's usage of "any target part" is also unclear and unhelpful for the jury because it is vague as to the scope of a "target" part and seems to require that a user take action to select the "target" part.

3Shape's proposed construction is further appropriate because it recites a missing "dental structure" that does not encompass *de minimis* errors that may arise during intraoral scanning, such as a hole in a 3D virtual mesh model or scanner noise. Despite efforts to meet and confer on this issue, it is not clear whether Align's construction is *not* intended to cover these type of *de minimis* errors. As such, 3Shape respectfully submits that its construction (excluding *de minimis* errors) is correct because a POSITA would have understood how to determine and generate data to correct these types of *de minimis* modeling errors well before the '527 patent. (*See* Ex. 36 at ¶¶ 29–36 (demonstrating this was well-known based both on personal knowledge and additional extrinsic evidence).) Because the remaining claim limitations cite techniques the '527 patent itself acknowledges were known, 3Shape's construction is both appropriate and necessary. (*See* '527 patent, 7:62–8:41); *Eastman Kodak Co.*, 114 F.3d at 1556.

B. [Issue K] The Scope of Generating Second 3D Data

1. "generating [generate] second 3D data" ('527 Patent, Cls. 1, 12)

3Shape's proposed construction of "generating second 3D data" is appropriate in view of

the specification's description of numerous methods of generating 3D data to virtually represent intraoral structures. Align seeks a far more limited construction that incorporates the two embodiments defined in dependent claims 6 and 7. (*See* '527 patent, cls. 6–7.) The intrinsic record does not support this narrow construction. Further, Align's proposed construction is legally flawed as it: (1) disregards the specification's disclosures that extrapolating and interpolating are exemplary, non-limiting embodiments, and (2) violates the doctrine of claim differentiation.

The Intrinsic Record Supports 3Shape's Construction. The '527 patent uses broad terminology when describing how 3D data of intraoral structures is obtained. For example, the specification explains: "3D digitized data of the intraoral cavity, including the dentition and associated structures of a patient, may be provided using any suitable equipment for scanning a patient's teeth" and "[s]uch scanning equipment may include any suitable optical scanner, for example, a hand-held scanner 31 that is used by the practitioner to acquire the 3D data." ('527 patent, 7:41–45, 7:62–64.) The specification then incorporates WO 00/08415 to Babayoff for teachings related to intraoral scanning to generate 3D data. (*See id.* at 7:64–8:5.) The Babayoff disclosure, which is part of the '527 patent's disclosure, describes an optical scanner that focuses light so that "data is generated which is representative of [the patient's intraoral] topology." (*See* Ex. 35 at Abstract; *see also id.* at 8:10–22 (describing a "purpose of generating data" by scanning).)

In another embodiment, the '527 patent explains scanning a cast of the patient's teeth can generate 3D data, again incorporating Babayoff by reference. (*See* '527 patent, 8:23–41.) The specification goes on to explain that other known intraoral scanning methods and/or X-ray, CT, MRI, or any other type of scanning of the patient or of a physical model can obtain 3D digital

data in a suitable manner. (*See id.* at 8:51–57.) This scan data may be associated with "a complete dentition, or of a partial dentition, for example such as a preparation only of the intra oral cavity." (*Id.* at 8:58–60.) Notably, this passage confirms that scanning can generate either 3D data representing a full dentition or a portion of the dentition.

For these reasons, "generating second 3D data" should include generation by scanning.

Align's Construction Violates Legal Principles. Align's proposed construction is legally flawed in two respects. First, Align seeks to cherry-pick two claimed embodiments and read them into the claims. This is improper. *See*, *e.g.*, *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1191 (Fed. Cir. 1998) ("particular embodiments and examples appearing the specification will not generally be read into the claims"). Second, Align violates the doctrine of claim differentiation because its construction would render dependent claims superfluous.

The '527 patent discusses a preferred embodiment in the context of the flowchart of FIG. 1, wherein extrapolated data is generated to reflect a missing portion of a margin line. (*See* '527 patent, FIG. 1, 10:16–43.) But the '527 patent states that this additional data generation "can be accomplished a number of different ways." (*Id.* at 10:20–21.) The specification then describes a specific embodiment, explaining "*[f]or example*" the extrapolation of FIGS. 6–7 can be performed. (*See id.* at 10:21–43.) The '527 patent does not even discuss interpolation in the context of generating second 3D data; rather, it discusses this term solely in the context of creating a demarcation profile to separate the two model parts. (*See id.* at 9:22–35.) This Court should not countenance Align's attempt to import arbitrarily selected embodiments into the claims, at the exclusion of others. The '527 patent (including the incorporated reference of Babayoff) describes that scanning generates 3D data; Align's effort to exclude scanning from "generating second 3D data" is therefore improper.

Finally, the Court should adopt 3Shape's broader construction because Align violates the doctrine of claim differentiation by proposing a construction that renders claims 6–8 and 17–19 meaningless. An interpretation of a claim that would render another claim in the patent "superfluous" is "presumptively unreasonable." *Beachcombers, Int'l, Inc. v. WildeWood Creative Prods., Inc.*, 31 F.3d 1154 (Fed. Cir. 1994). Here, dependent claims 8 and 19 each recite that "the second 3D data is generated based on the 3D virtual model." ('527 patent, cls. 8, 19.) Accordingly, 3Shape's proposed construction of the independent claim terms (which allows for scanning to generate the second 3D data) properly affords these dependent claims a narrower scope. Align's proposed construction, however, renders these claims superfluous. In particular, the interpolating between 3D points in a model or extrapolating the 3D virtual model described in Align's proposed construction are both data-generating techniques "based on the 3D virtual model" as recited in claims 8 and 19. Additionally, Align's verbatim copying of dependent claims 6–7 and 17–18 into its proposed construction rendering these dependent claims superfluous. This is improper. *See Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004) ("[W]here the limitation that is sought to be 'read into' an independent claim already appears in a dependent claim; the doctrine of claim differentiation is at its strongest.").

Accordingly, the Court should adopt 3Shape's proposed construction.

IV. CONCLUSION

For the foregoing reasons, 3Shape respectfully requests the Court adopt 3Shape's proposed constructions.

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Respectfully submitted,

/s/ Max Ciccarelli

Bruce S. Sostek (No. 1885570)
Bruce.Sostek@tklaw.com
Max Ciccarelli (No. 00787242)
Max.Ciccarelli@tklaw.com
Thompson & Knight LLP
One Arts Plaza
1722 Routh Street
Suite 1500
Dallas, TX 75201-2533
Tel: 214.969.1237
Fax: 214.880.3252

Counsel for 3Shape Trios A/S and 3Shape A/S

Kimberly Coghill *(pro hac vice)*
Bryan J. Cannon *(pro hac vice)*
TROUTMAN PEPPER HAMILTON SANDERS LLP
401 9th Street, N. W.
Suite 1000
Washington, D.C. 20004
Tel: 202.274.2950
Fax: 202.274.2994

William D. Belanger *(pro hac vice)*
Gregory Len *(pro hac vice)*
Frank D. Liu*(pro hac vice)*
Brittanee Petrik *(pro hac vice)*
Ana Spone *(pro hac vice)*
Gwendolyn Tawresey *(pro hac vice)*
TROUTMAN PEPPER HAMILTON SANDERS LLP
125 High Street
19th Floor, High Street Tower
Boston, MA 02110
Tel: 617.204.5100
Fax: 617.204.5150
Email:
3Shape979Troutman@Troutman.com